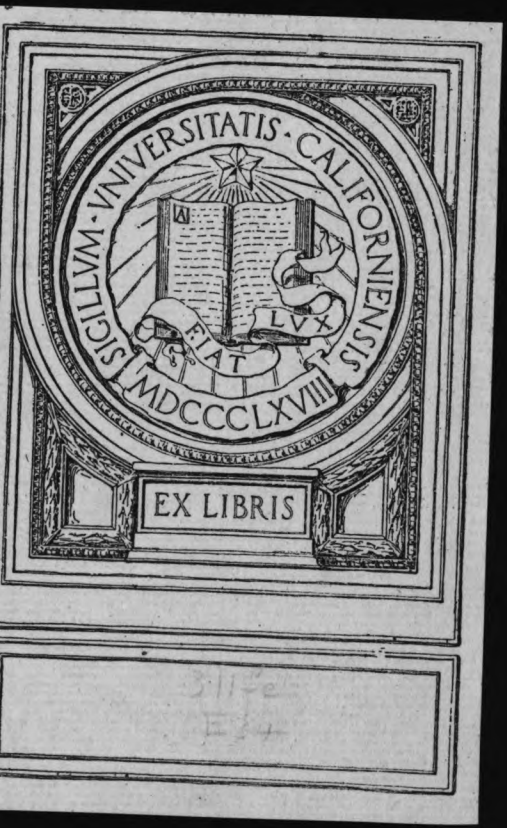
Fire Prevention and Fire Protection *for* Hospitals

By OTTO R. EICHEL, M. D.



A MANUAL

OF

FIRE PREVENTION

AND

FIRE PROTECTION

FOR

HOSPITALS

BY

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PREFACE

It is the purpose of this manual to provide in convenient form an outline of the principles of fire prevention and protection with indications for their application in institutions housing the sick. It is planned for use not only by superintendents and boards of managers, but also by inspectors, architects, builders, and others who have occasion to consider the fire problem in hospitals.

As has been pointed out by high authority, the extent to which the subject generally is neglected by many institutions is hardly less than criminal. Indeed, in many hospitals only a merciful Providence seems to prevent unspeakable disasters. The author's personal observation and study of this

condition have resulted in the preparation of this manual, which, it is hoped, will meet a real need.

The author is much indebted to Dr. Hermann M. Biggs, New York State Commissioner of Health, for permission to publish this work; to his Deputy, Dr. Linsly R. Williams, for the suggestion to prepare it; to Mr. Franklin H. Wentworth, Secretary of the National Fire Protection Association, for valuable suggestions, and to Dr. Willard J. Denno, Secretary of the New York State Board of Medical Examiners, for criticism of the manuscript.

OTTO R. EICHEL, M.D.

Albany, N. Y.,
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HOSPITAL FIRE MANUAL

PART A—INTRODUCTORY

I

DEFINITIONS AND ABBREVIATIONS

For the purpose of this book the following abbreviations are used:

N. B. F. U.—The National Board of Fire Underwriters is an association of practically all the fire insurance companies in the United States. Through its committees it promotes legislation, suppresses arson, collects statistics, and makes scientific studies of fire origins and means of prevention and protection. Has branch offices in many cities. Main office, 76 William Street, New York City.

N. F. P. A.—The National Fire Protection Association includes nearly all the associations, companies, bureaus, and institutions interested in fire prevention and fire protection in the United States and Canada. It has a world-wide subscribing membership. It promotes fire prevention and protection in every possible way. Its work is broader in scope than that of the N. B. F. U., which is one of its members. It prepares many valuable publications on fire matters, one of the most useful being its "Field Practice." It does educational work and establishes standard rules, requirements, and specifications regarding hazards and their safeguarding, fire equipment, etc. Its standards are adopted by the N. B. F. U. and its laboratories, and are universally recognized as authoritative. Address, 87 Milk Street, Boston, Mass.

U. Lab.—The Underwriters' Laboratories, Inc., are under direction of **N. B. F. U.** They make examinations and tests of fire devices, materials, and apparatus under standards recommended by the N. F. P. A., and publish a list of manufacturers of such appliances, which is revised semi-annually.

National Electrical Code.—This code contains recommendations for reducing the hazards of electricity. It is promulgated by the N. B. F. U. from recommendations made by the N. F. P. Association's Electrical Committee, formerly known as the Underwriters' National Electric Association. The code is generally accepted as standard.

Fire Hazard.—A condition which may cause fire.

Fire Prevention.—Concerns fire hazards,

educational and private administrative measures, and legislation.

Fire Protection.—Concerns control by means of construction features, fire appliances, and safeguards against hazards.

II

GENERAL CONSIDERATION

Prevention and Protection.—It is a notable fact that hospitals often approach the fire problem from the view-point of protection rather than prevention; and occasionally with regard chiefly to protection of property instead of human lives. This is unfortunate, as it results in the neglect of attention to those common hazards which cause the majority of fires, and the installation, instead, of expensive appliances, the proper use of which may be neither practised nor understood. It is of primary importance to detect and safeguard the simple hazards, and to provide adequate protection for lives first.

Hospital Fires.—Although in the past the loss of life in hospital fires has been comparatively small, the aggregate loss in property has been large. Fires in hospitals are by no means so infrequent as one might suppose. While making a survey of certain tuberculosis hospitals in New York State, the author found that during a brief period of time they had suffered from a number of incipient fires: two from electric flat-irons, three from gas appliances, two from defective flues, two from kitchen ranges, four from adjoining woodlands, two from incinerators, and in two more instances large frame buildings were entirely destroyed. Such accidents are not rare in hospitals generally. The publicity given these incidents was very limited, probably because no lives were lost. However, it should not remain for a hospital holocaust corresponding with the Iroquois

Theatre fire to awaken hospital authorities to the gravity of the fire risk in which, only too often, they house the bed-ridden sick. The hospital is virtually a large residence. Fires of the residence class, of both known and "unknown origin," are usually due to such common and easily preventable causes as electrical or gas hazards, or defective flues and chimneys.

The Cost of Fires.—The importance of the matter may be further emphasized by viewing it in the light of the problem generally. Experience has shown the danger to life to be greater in buildings where people live than in those where they work or play. It is believed probable that more lives are lost in residence fires than in factories, theatres, and schools combined. The popular mind entertains the obverse conception of the facts, probably because only the fire which

destroys many lives receives wide publicity. Fire causes an average annual property loss in the United States of $250,000,000—$30,000 per hour, or $500 per minute; an annual per capita fire tax of $2.50. This enormous loss is especially deplorable as most fires are readily preventable. Economic conditions are necessarily affected by such large losses. They must be met by the insurance companies from their collections, which are practically an assessment on all the people.

The Fundamental Evil.—It is not only of primary importance to prevent fires by safeguarding the common hazards, but also by obviating such fundamental causes as the carelessness, indifference, and negligence of the average citizen. It has long been recognized by fire experts that to these are due the much greater prevalence of fires in

this country than in Europe. This can be accomplished in a democratic state only by education, and to some extent by enforced legislation.

III

RECOMMENDATIONS

Below are enumerated certain general recommendations for all hospitals. These are an application to the conditions found in hospitals, of well-established facts and principles regarding fire prevention and fire protection:

1. That there be strict compliance with existing local or state *laws* regulating fire-hazards, e.g., regarding explosives, matches, motion-picture machines, building codes, fireworks, chimneys and flues, inflammable liquids, etc.

2. Cooperation and consultation with the *local fire department* within whose district the hospital may be located.

3. Consultation with the *Fire Underwriters* and compliance with their suggestions in every instance where they have jurisdiction.

In every case where it is possible without conflict with results of the foregoing steps, it is further recommended:

4. That in every hospital where any of the *fire hazards* described in Part B below exist such steps as are outlined be taken to safeguard against them.

5. That each hospital have a minimum *fire apparatus of "small size"* (1½ gallons) or of the *"one quart size" chemical hand extinguishers* as described on page 34, an adequate number to be distributed on each floor of each building. That the standard size (2½ gallons) extinguisher be discontinued where patients and women and children may be obliged to handle them.

The use of chemical extinguishers on wheels to be optional. They are expensive but valuable for isolated hospitals. That fire pails be used as secondary equipment. That for garage, electrical machinery, and hazardous fluids the *one-quart chemical hand-extinguisher* and pails of sand, as described on page 37, be used. That dry powder and grenade type extinguishers be abolished.

6. That appliances described on pages 43 and 45 (*fire-doors, escapes, and ladders*) be used where the fire safety could be greatly improved within the limitations outlined.

7. That *appliances* described on pages 43 and 44, such as *paints, hose, faucets,* and *alarm box,* be adopted so far as possible.

8. That the *water supply* be given attention as described on pages 51–52.

9. That all the miscellaneous precautions described in Part D regarding *valves, hy-*

drants, gravity and pressure tanks, and locked doors, be observed in all hospitals to which they may apply.

10. That *private fire departments* be established in all hospitals, with rules, organization, drill, and inspection service based on the general outlines given in Part E and within such limitations as may be necessary.

11. That *educational work* be done in fire prevention and protection, as outlined on page 66, within such limitations as may be necessary.

12. That so far as possible no fire *devices*, *materials*, *apparatus*, or other appliances be purchased except such as are approved in the latest list issued by the U. Laboratories, and that other safeguards and means of protection comply with the standard rules, requirements, and specifications of the N. F. P. A.

PART B — COMMON HAZARDS IN HOSPITALS AND THEIR SAFEGUARDING

I

LIGHTING HAZARDS

1. Candles.—The use of candles presents a constant danger, as they are very combustible, easily dropped or tipped over, can fall into small openings, present an unguarded flame, may continue to burn after being dropped, and the wick may glow after flame is extinguished. There is practically no instance in which they could not be abolished. The small electric hand torch is much safer and should be used instead.

2. Gas Jets.—These present a constant fire hazard if located very near to walls,

ceilings, shelves, attic roofs or rafters; or where open doors may come in contact. Where inflammable material may touch the jets, as in storerooms and closets, the jets should be entirely removed or, in some cases, lengthened and the lights protected by wire bonnets. Movable jets should not be used.

3. **Gas Lamps.**—They should have broad bases and no inflammable trimmings, and only non-inflammable connections. They should not be used if electric lights are available. All gas hose of flexible tubing contains rubber, and therefore will burn, although some types have metallic covers. Rigid installations should be secured wherever possible.

4. **Kerosene Lamps.**—The danger from this common cause of fires needs no emphasis. Their use should not be permitted,

but if essential they should be of metal and of broad base design, or of non-capsizable construction.

5. Lanterns.—These present the same conditions, and the same general precautions should be observed as in the case of kerosene lamps. If they are essential, only good safety lanterns, should be used—of the type used by watchmen and railroad employees (broad base and protected with wire fenders). The lantern having a removable bottom for oil should not be used—such bottoms may become loose and drop out.

The electric hand torch is to be preferred wherever possible.

N. B.—If much kerosene is needed, as for lamps, lanterns, heaters, stoves, etc., only high test oil should be used, as required by the U. S. A. specifications, or as used by the railroad companies. Such kerosene

is said to be superior also in other respects to the ordinary kind.

6. Alcohol Lamps.—Their use can usually be limited to the laboratory, and even there they should be abolished, if possible, and stationary gas flame used instead. Benzine and gasoline should be kept away, especially if kept in bottles which may be mistaken for alcohol bottles.

7. Electric Lamps.—Especially if old, incandescent lamps become very hot, and will char paper or cloth if in contact with them, and have even been known to ignite wood. Usually paper and cloth shades should not be used on electric lamps.

Incandescent lamps should be stationary, wherever possible, and not in contact with combustible material; movable lamps should be equipped with wire-bonnets or similar protective device; cords should not be hung

over non-insulated places, as pipes, nails, hooks, etc., and should not have knots tied in them.

Electric lighting systems, their use and changes and extensions in them, should be in accordance with the requirements of the National Electrical Code. Injuries to the system, or its disturbance by storms, etc., should usually be corrected by expert electricians.

8. Acetylene Systems.—The hazards of these systems may be safeguarded by observing the "Standard Rules and Requirements" of the N. F. P. A.

II

HEATING HAZARDS

1. Fireplaces.—The chief precautions necessary are proper construction, to have the flooring about the fireplace of non-combustible material, and to protect against flying sparks or rolling logs by good and-irons and screens. The latter to be of such size and design as to completely cover the front of the fireplace and not tip over easily. The one-piece screen with curved top is usually to be preferred. (See N. F. P. A. suggested Municipal Ordinances).

2. Stoves.—(*a*) *Coal*—There is but slight danger from coal stoves if properly installed and cared for. They should be erected on metal legs; stand on zinc, sheet iron, or asbestos base; and be placed at a safe

distance from walls or inflammable matter unless latter are protected. Ash receptacles of metal only.

(*b*) *Gas.*—Gas stoves, ranges, plates, burners, and water heaters should be connected with the gas supply line by rigid iron piping; the soft rubber and other inflammable connections are among the most dangerous common fire causes, and should positively not be used. Practically all flexible gas hose contains rubber and will burn, although some types have metallic covers.

These gas appliances, as well as coal stoves, should be properly mounted on zinc or asbestos, and be safely clear from walls and combustible matter, unless the latter are protected by metal or asbestos.

(*c*) *Electric.*—Electric stoves, heaters, and plates are comparatively safe and much to be preferred to coal, gas, oil, and alcohol

appliances. There is danger in their use, however, if circuits are overloaded or if near combustible matter, and general wire dangers are always present where any electric current is used. These hazards are reduced to a negligible minimum by proper installation (as required by the National Electrical Code).

N. B.—The *electric flat-iron* offers the greatest and most prevalent electrical hazard of the day, and has been the cause of numerous fires. These have invariably resulted from carelessness, as leaving the current on when not in use. This may be avoided by having a small red pilot light on the irons or in the same circuit to indicate when the current is on. They should never be allowed to stand on inflammable material when the current is on, only well insulated cord should be used, and this should not be

tied or knotted, and should be kept clear from hooks, nails, piping, and other non-insulated places.

3. Furnaces.—The chief danger is in overheating. This can be obviated by careful attention to fires and by proper construction and installation.

4. Stove-Pipes.—If they pass through closets, unused rooms, blind attics, or enter chimneys out of sight, present a constant fire danger. Stove-pipes should not be passed through floors, roofs, ceilings, walls, partitions, or sides of buildings, unless protected by metal ventilated thimbles having a 6-inch clearance.

5. Steam-Pipes.—These may constitute a source of danger, especially if improperly installed. Wood may spontaneously ignite after being charred by contact with overheated steam-pipes. This possibility has been

proven by both observation and laboratory experiment. Floors and walls should be protected from such pipes by metal collars; the pipes should be insulated with asbestos or non-combustible packing where they pass close to walls, ceilings, or floors, and in the latter instance properly supported or suspended. Oil waste, coal dust, and other highly inflammable material should be kept away from steam-piping.

6. Chimneys.—If poorly constructed, cracked, overheated, or *used as supports for flooring, timbers*, etc., may be a potent source of fire danger. This is especially true if an ordinary chimney is used as a support, owing to the loosening of the chimney and subsequent ignition of the wood. This is a fairly common cause of fire, especially in rural frame buildings. (See the N. F. P. A. suggested Municipal Ordinances.)

III

EXPOSURE HAZARDS

N. B.—These exist where buildings are adjacent to risks, such as other buildings or forests, or in parts of buildings apt to be exposed to extending fires, or to adjacent risks connected by corridors, etc. An *extending fire* is naturally a very serious menace to the rest of a building. (See also paragraph 7 on page 32.) Protection against it may be afforded by mill construction, wired-glass windows, fire shutters and doors, and by fire-walls after the Porter plan, as carried out in some of the New York City Hospitals. For instance, skylights should contain wired glass, corridors may be protected by fire-doors or shutters, etc.

1. **Forests.**—If near buildings they constitute an important fire hazard. If they are extensive the construction of a fire-line through them at some distance from the buildings should be considered, as has been done at the New York State Tuberculosis Hospital at Raybrook. Sufficient spades, shovels, and axes should always be available, so that several men may instantly attack a forest- or brush-fire. The one who will be responsible for the direction of the fighting should be familiar with the various means of controlling forest-fires. During times of drought special precautions should be taken to protect forests (see State and United States Government bulletins, etc.).

2. **Buildings.**—Adjacent to other structures constitute a danger. Each case will require separate study. Where frame corridors connect buildings a slow-burning con-

struction of corridors, fire-doors, and hydrants suitably located, may be advisable.

3. **Sparks.**— From power-house stacks, chimneys (especially from fireplaces), and passing locomotives are dangerous. Where such conditions are possible wood-shingle roofs should be replaced with fireproof roofing (see the N. F. P. A. paper on "The Evil Shingle Roof").

4. **Automobiles.**— Obviously endanger buildings in which they are housed. They should not usually be stored in barns and never in structures occupied by people or live stock, or for the storage of valuable material, nor in the non-fire-resisting structures which are themselves large and expensive, or which by their location endanger near-by property.

IV

MISCELLANEOUS HAZARDS

1. **Coal.**—If improperly stored may spontaneously ignite, and under certain conditions coal-dust may explode. For details of preventive measures, see "Field Practice," of the N. F. P. A., and Freitag on "Fire Prevention and Fire Protection."

2. **Chemicals, Paints, Oils, Inflammable Volatiles, and Explosives.**—For preventive measures see the "Field Practice" mentioned above; and in safeguarding hazards from the storage, handling, and use of such materials, the "Standard Rules and Requirements" of the N. F. P. A. should be carefully observed. These rules also cover the details of construction and installation of Acetylene Machines, Gas and Gasoline

Engines, Valves, Lighting Machines, Oil Storage, etc.

3. Smoking.—This prevalent cause of fires needs hardly any emphasis. Some fire experts believe it to be the commonest cause of all fires. In certain places smoking or the carrying of lighted cigars, pipes, or cigarettes should be strictly forbidden under severe penalty, and the rule should be rigidly enforced, as in barns, paint shops, carpenter rooms, storerooms, garages, etc. As most cigarettes burn until they are entirely consumed, their use in certain instances should be entirely prohibited.

4. Lightning.—This is a fairly common cause of fire, especially in frame buildings. It seldom strikes a steel frame building, but is said to strike residences and rural frame structures much oftener than is generally believed.

Good rods of correct design, placed on all spires and projecting points, furnish the best protection.

Where cattle are enclosed with wire fences every sixth or eighth post should be grounded in an effective manner—the ground rod terminating with a copper plate bedded in charcoal.

Lightning protection should be in accordance with the standard rules and requirements of the N. F. P. A. During electric storms and after any building is struck by lightning, there should be a careful inspection to ascertain the existence or possibility of fire from injured electric wires, chimneys, etc.

5. Holiday Celebrations.—Independence Day and Christmas Day celebrations have been a prolific source of fires, owing to the use of fireworks, inflammable decorations,

defective temporary wiring, candle illuminations, etc.

When preparing for such celebrations the "Holiday Bulletins" of the N. F. P. A. should be consulted. These are issued annually, preceding July 4 and December 25, and contain valuable suggestions for fire prevention and protection.

6. Ashes, Rubbish, Sweepings, Inflammable Refuse, etc.—The careless disposal of these materials is a common cause of fires, although plainly enough they should be kept away from stoves, fires, hot steam-pipes, or other places where ignition is possible by contact, should not be allowed to accumulate, and the receptacles used should be of metal. Especially ashes and oil or cotton-waste always should be disposed of in metal cans.

(See the U. Lab. list of manufactures of

approved types of safety cans and waste cans, tanks, fire pails, etc.)

7. **Fires.**—Fires themselves, naturally, offer a great hazard because of the possibility of apparently extinguished fires continuing to burn in concealed places or to smoulder and blaze forth later. (See also *N. B.* to Sec. III, of Part B.)

"Make sure it's out,"—where there is smoke there is apt to be fire. If the fire has burned in concealed places (between walls, under roofs and cornices, or in inaccessible places), it may be well to leave a guard until it is certain that the fire is completely out. All fires should be immediately followed by a careful investigation to ascertain the extent of possible damage to electric wiring, chimneys, flues, etc.—conditions which themselves may be very dangerous.

PART C — FIRE APPLIANCES AND SAFEGUARDS

N. B.—Consult also the U. Lab. list of approved "Fire Appliances," which contains a list of manufacturers. The list also gives brief descriptions of the standard articles.

I

CHEMICAL EXTINGUISHERS

1. Chemical Extinguishers on Wheels, 33 Gallons.—"These appliances are effective on fires where water or solutions containing large percentages of water are effective. Their use on electric arcs or wiring carrying high voltages may be dangerous on account of the conductivity of the liquid. They are

of limited service in hazardous fluid fires. They must be protected from freezing." (U. Lab.)

These extinguishers are valuable for hospitals not readily accessible to a municipal fire department, for the fighting of fires beyond the incipient stage.

2. Chemical Hand Extinguishers.—(*a*) *The standard size, 2.5 gallons,* is useful on incipient fires within the limitations described above for wheel extinguishers. It is highly efficient but heavy and difficult for women and children to handle.

(*b*) *The small size, 1.5 gallons,* is preferable in most instances, as it is "intended primarily for use by women and children" (U. Lab.).

N. B.—The chemicals used in the "wheel," "standard," and "small size" extinguishers are sodium bicarbonate and sulphuric acid.

(*c*) *The one-quart size hand* extinguisher utilizes special liquids, the chief ingredient of which is said to be carbon tetrachloride. These hand extinguishers have the great advantages of being so small that they can be handled by women, children, and ambulant patients; one person can carry several of them at one time; they are effective on incipient fires in hazardous fluids, cotton, and fabrics, rapidly burning materials, and in fires not easily extinguished by water (as volatile liquids and oils); they can be used on electric arcs or wiring carrying high voltages without danger to the users; will not freeze; and the liquids used will not usually damage fabrics and other ordinary articles. They are especially serviceable for garage and automobile use, and about electric machinery and arcs. " They are not recommended for service on fires in

freely burning material (such as wood) of any considerable quantity." (U. Lab.)

N. B.—Chemical hand extinguishers should be readily available on each floor of a building, including cellar and attic, in very accessible places, preferably in hallways and near red lights. They should be inspected, tested, and refilled as often as necessary, and bear tags giving dates of refilling in ink, typewriting, or stamped. See the U. Lab. list for manufacturers of approved types of extinguishers.

II

OTHER HAND EXTINGUISHERS

1. **Pail Type.**—Made in 8, 10, 12, and 14-quart sizes. Pails of water are the best and cheapest fire extinguishers known for most of the ordinary beginning house fires. Everybody understands their use and almost anybody can use them. Their use is, of course, limited to fires in which water is effective, and which can be easily reached by water thrown from a pail. They are of little use on oils and inflammable liquids, and are dangerous on electrical arcs and machinery, and on high-voltage wires. In such places pails filled two-thirds full of clean, dry *sand*, containing scoops for throwing it, are useful accessory means of protection. More valuable, however, for this

purpose, are the one-quart size hand extinguishers mentioned above.

The smaller pails are preferable for hospitals, as they can be more easily used by women, children, and patients. They should be made of iron, steel, or fibre; have rounded bottoms so they cannot easily be used for other purposes or misplaced; should be painted red and marked with the words "Fire" or "For Fire Only" in black letters, 2½ or more inches high; should be suspended from brackets or placed on shelves containing pail-holes, and never on window-sills, work-tables, stock-shelves, or other places not intended for them; the tops of the pails should not be over 5 feet above the floor and the bottoms not less than 2 feet above it; they should be refilled once weekly with clean water, and one person held responsible for their care; when exposed to low tempera-

tures the contents should be protected against freezing by the addition of 2 pounds of common salt, or preferably 2 pounds of calcium chloride, to each pail, with thorough stirring to dissolve (see "Freezing Preventives for Fire Pails" and "Water Barrels and Pails," by N. F. P. A.). As a general rule there should be two or more pails for each 1000 square feet or fraction thereof; this will necessarily vary where the floor area is not continuous but divided into room space, halls, etc.; the various small areas may not be so accessible as one large area, and may therefore require more pails in proportion; the pails should be located near the most vulnerable points, in plain sight, and in no manner covered or obstructed.

It is advisable to use such pails only as are listed by the U. Lab.

2. Dry Powder Hand Extinguishers.— These are the least reliable and most inefficient extinguishers known. Unfortunately they are also very widely used, and can be found in many hospitals. The writer has seen one hospital which contained no other equipment except stand-pipes and hose. The extinguishers could not be opened by jerking or pulling, and readily sustained 180 pounds weight; the hose attached to the stand-pipes was so large that with a full stream it could have been handled only by trained firemen or strong men. The dry powder extinguisher proved to be worse than useless in the famous Iroquois Theatre fire.

This type of extinguisher usually contains bicarbonate of soda, a small amount of coloring-matter, and some starch or clay to prevent caking.

They are of very slight value in a certain class of fires as first-aid accessories where the temperatures are very low, in museums, libraries, on inflammable liquids, and electrical machinery, and where water itself may be as bad as fire. Even so, they still present difficulties in opening and scattering the contents, owing to the metal caps and tubular shape. Pails of sand are very much better.

Furthermore, considering their extremely limited utility, general inefficiency, and cheap construction and contents, they cannot be regarded as inexpensive when sold for several dollars apiece.

(They are not mentioned in the U. Lab. list of approved fire appliances.)

3. Grenade Type.—This type, usually consisting of bottles containing fluids, a large percentage of which is water, is of

so little value as to be practically worthless. The false sense of security which may result from their presence, and the time lost in attempting to quench a fire with them, may be very dangerous. They are hardly equivalent in value to a pitcherful of water. (They are not mentioned in the U. Lab. list of approved fire appliances.)

III

OTHER APPLIANCES

1. Fire Doors and Shutters.—The use of these in corridors connecting adjacent buildings, or to close openings in fire walls, or for walls which are partially fire-proof, should be carefully considered and, in many instances, is very advisable. The U. Lab. have listed a large number of firms which supply approved types of fire doors, shutters, etc.

2. Fire Retardant Paints.—These are valuable, as they retard the spread of fire. There are many places in hospitals in which they can, and should be used. Wherever possible they should be used instead of shellac, varnish, and oil, especially as the latter are more inflammable than ordinary

paints. Many uncoated wood surfaces could advisedly be covered with fire retardant paint. (See the U. Lab. list of manufacturers of approved paints.)

3. Fire Hose and Faucets.—*Hose* should be rubber lined or unlined linen, made in accordance with the standard specifications, and passed by U. Lab. (See their list of approved appliances for names of manufacturers.)

It should be of sufficient length to reach all enclosed places and not less than 2½ inches diameter; tested at stated intervals, and bear a tag giving dates of inspections and tests; and always be connected with stand-pipe, ready for emergency use.

Faucets.—Some or all of the ordinary water taps should be threaded for the attachment of garden hose, which can be of service as supplementary fire equipment. Such

hose can be handled by women and children, whereas the regular fire hose (2½ inches or more) requires one or more strong men or trained firemen.

4. Fire-escapes and Ladders.—Many of the numerous types of fire-escapes are not suitable for hospitals and some should not even be considered. Among these are escapes consisting in part, or entirely, of vertical ladders, which end in a locked door, or any part of which is not protected by railing, or is not of sufficiently substantial design to inspire confidence. Fire-escapes should usually extend to the roof, especially if the latter contains skylights or other exit facilities. If improperly located or constructed they may be both dangerous and useless. Escapes should be tested from time to time, and repainted sufficiently often to prevent rusting. They should be kept

clean in winter—if covered with snow or ice they may be useless when needed, or cause fatal accidents.

One or more extension *ladders* may be valuable in fighting advancing fires.

5. Fire-Alarm Box.—Every hospital which is reasonably accessible to a municipal fire department should endeavor to have a fire-alarm box installed to signal the department-headquarters, and arrange for response to hospital alarms. The Rochester, N. Y., Fire Department has gladly extended this assistance to "Iola," the Monroe County Tuberculosis Hospital, situated a short distance beyond the Rochester City Line. (See also page 61.)

6. Sprinkler Systems.—These are, briefly, appliances for the spraying of water over the area of an incipient fire. The heat of the fire to be extinguished automatically

frees the water by acting upon the valves or "heads" of the sprinkler system. They usually give adequate protection if properly installed, and carefully supervised and maintained.

The sprinkler appliance may be of value in large hospital buildings whether they are fire-resisting or not, if they contain large untenanted portions, and especially if such portions contain much inflammable material. Each hospital, however, may present a separate problem, and the question must be studied with regard to the fire problem as a whole.

A hospital planning to install a sprinkler system should act only upon the advice of a competent fire-prevention engineer. It is further advisable for the sprinkler system, if adopted, to be installed in accordance with the rules and regulations of the N. F. P. A.

The successful operation of a sprinkler system necessarily depends upon adequate water-supply and -pressure and immediate automatic opening of the sprinkler-heads. The system should be inspected at definite intervals, usually not less often than once monthly, so that deterioration, obstruction, etc., may be prevented. For instance,

1. Dust and dirt should not be allowed to accumulate on the heads.

2. The heads should not be painted, nor covered with oils, polish, whitewash, wax or other coatings, *except when first installed, and then only* with an anti-corrosive coating recommended by a reliable expert.

3. Shelves, stored material, etc., should not be permitted even temporarily to obstruct the heads.

4. Heads which appear to be injured should be *promptly* replaced. If several

appear spoiled, that part of the system should be tested.

5. Extra sprinkler-heads should always be on hand, ready for use. Various employees should be informed as to their place of storage.

6. After a fire the open heads should be immediately replaced and *valves opened promptly.*

7. Valves should always be *open*, except when temporarily closed for repairs, etc.

8. Check up, with a list on file, all sprinkler gate-valves, noting those which are not open and strapped, reasons therefor, etc.

9. Repairs, when necessary, should be made immediately, and only by a mechanic who thoroughly understands such work.

10. Pressure gauge should be noted and report made to Superintendent and Chief Engineer if too low.

11. Attention should be given to all conditions mentioned in Part "D" on water supply.

12. These duties should usually be made a part of the regular required duties of one or more regular employees, and not secondary to other tasks.

PART D—MISCELLANEOUS PRECAUTIONS

1. **Water-Supply.**—The adequacy of the water-supply and water-pressure for fire fighting should be determined. This is especially important in large buildings. It is advisable, preferably in the Spring and Autumn, when the hydrants are flushed, to place the entire system under pressure to ascertain the soundness of the piping, valves, hose, etc.

2. **Valves.**—All valves, especially in basements, engine-rooms, closets, or concealed places, which may be used to shut off water-supply from buildings or sections of buildings, should be painted a bright red, and have securely attached to them (with wire) tags stating in typewriting or ink the exact

building or part of same which they control. This is especially important if they control a separate water-supply to stand-pipes or risers,—such valves and others, closed only when making repairs, should be *locked open* to prevent tampering with them.

Valves which must be kept closed should be tested weekly by giving them a quarter turn. They should not be closed too tightly. The writer has visited hospitals in which important valves could be opened only with great difficulty.

3. **Hydrants** should be opened and flushed thoroughly in the Spring and Autumn, tested from time to time, always kept free from obstructions, and protected against freezing during the winter.

4. **Gravity and Pressure Tanks** should be carefully inspected from time to time. Hoops, telltales, and glass-gauge valves

should be kept in good condition. Air-pressure and water-level should always be properly maintained. During the Winter care should be taken to prevent the formation of ice in gravity-tanks. Pressure-gauges should be inspected frequently.

5. Locked Doors.—Any door which is kept locked all or part of the time, which may be needed as an emergency-exit, should have placed near or upon it a fire axe, or the door-key in a glass-faced box, or should be locked with padlock having brittle shackle, or should be equipped with all of these, depending upon the circumstances. The padlock with brittle shackle is an excellent means of locking doors, hose-boxes, etc., where an appearance of security is desired without preventing easy access. (Refer to the U. Lab. list of manufacturers of approved appliances.) It must not be for-

gotten that the door which can be readily broken open by a kick or body pressure exists chiefly in drama and fiction; even ordinary doors cannot be opened easily in this way, and many will resist the combined efforts of several strong men. Such locked doors have caused the loss of many lives.

PART E—HOSPITAL FIRE DEPARTMENT

Although in many hospitals only the incipient fire can be controlled, it is nevertheless necessary to have an adequate organization, drill, and equipment in order to retard an extending fire, and thus afford time for the safe removal of all occupants and valuable contents. Practically every hospital should have a private fire department planned along the lines described below.

1. **Rules.**—These should be as few as possible, and clearly and concisely worded. The *general* rules must also meet the peculiar needs of each hospital. They will usually forbid the use or possession, or both, of matches, candles, tobacco, lamps, alcohol, heating devices, the accumulation of waste,

papers, etc., except by written permission of the superintendent; they will forbid tampering with fire appliances, and will direct what to do if fire is discovered—as reporting to nurse in charge of floor or building, or to superintendent, etc. (such person being in each instance the nearest officer in authority). *Special* rules will be required to safeguard certain hazards, as in barns, garage, storerooms, attic, kitchen, laundry, etc. The storing of automobiles, motor-cycles, and hazardous fluids except in places designated should be forbidden. The *rules* prescribing the duties of each *employee* (see also pages 60 and 65) will include a clear definition of their responsibilities in the event of fire, and from time to time separate instructions may be given to selected patients. The *plan of fire organization* should be included in the rules, or posted separ-

ately; if a location alarm is established the location signals should be conspicuously posted. It is usually best to post the general fire rules in conspicuous places, possibly to print them in red, on a buff-colored cardboard or paper, and plainly headed "FIRE RULES." The penalty for their infraction should be stated and usually strictly enforced.

2. Organization.—The type of hospital buildings, classes of patients treated, number of employees of each sex, etc., must govern the manner of organization. The objects to be accomplished may be mapped out in their order of importance, the most difficult first. For instance, lives are more important than property, the children and bed patients will require more assistance than ambulant patients and employees, and the office contents are more important than

patients' personal effects. Usually the fire is discovered in its incipiency when only few fire-fighters are needed, but a number of attendants may be needed immediately to remove the children and bed patients. In this there must be no delay, as incipient fires often spread and destroy lives and property with unbelievable rapidity. Therefore some form of organization on the following lines is necessary·

Inspector.....Chief.....Messengers.

Asst. Chief.

Floor Captains.

Rescue Company	*Fire Company*	*Salvage Company*
Stretcher men	Extinguisher men	Any persons available after rescue work is finished.
Exit guards	Pail men	
Stair guards	Hose men	
Hall guards	Ladder men	
	Engineer	
	Asst. to engineer	

The chief should be the chief resident officer, the assistant chief the next in authority; and the floor or pavilion captains should be the nurses in charge. The inspector may be the night-watchman, and the messengers will be any patients or boys who may not be strong enough or sufficiently skilled to assist with rescue work or fire fighting. The rescue company should consist of a sufficient number of able-bodied men or women to remove the children and bed patients. Guards may be needed to prevent crowding and accidents in hallways, fire-escapes, and doors. The engineer should usually have no other duties than to attend to the engine-room. Usually also he will need one assistant or fireman, especially if one or more fire-pumps are in use. The extinguisher, pail, and hose men will preferably be employees, who can be trained

to handle the fire appliances with rapidity and effectiveness. The salvage company will include any able-bodied and available persons not required for fire apparatus or rescue work, to save such property as can be readily removed from the buildings. The hose men should be strong, as a fire hose stream cannot be easily handled by any others—at least two men are usually necessary.

3. The Fire Drill.—The object of the *drill* is twofold, viz.: (1) to *train the employees* and others to effectively man the fire apparatus, and (2) to *prevent panic* by teaching patients and employees self-control and by training them in orderly and rapid methods of exit.

The *signal apparatus* may consist of a fire-whistle or electric bells or gongs (see N. B. F. U. approved list). An alarm

should be selected which is loud, but of soft tone to prevent unnecessary excitement. Two signals should be arranged for—one for drill and one for real fire. The fire-signal may be so given that the actual location of the fire is also indicated by a succession of gong-strikes, bell-rings, or whistles.

Immediately upon the *drill* signal being given all persons shall report to the stations assigned to them, and immediately prepare to perform the duties required of them by the rules. The stretcher men and guards will report to rooms or wards containing bed patients and children, to remove them under the direction of the nurse in charge, who acts as floor captain. After all have been presumably removed these men shall report to the floor captain for further duty. The extinguisher men and pail men will immediately report at the site

of the fire, bringing the appliances in their charge. The hose men will man the hose at the site of the fire. These will work under the personal direction of the chief or his assistant. The engineer must start the fire-pump immediately upon hearing the drill alarm, raise the water-pressure, stoke fires, etc., without awaiting further orders. The salvage company will take orders from the chief or his assistant, and their work may be organized on the ground after the alarm is given. In small hospitals this company may be incorporated with the fire company. The inspector and the messenger will perform such duties as may be assigned them, the latter being prepared to render personal service to the chief, carry messages, etc. The inspector may be used to attend to the hose lines, signal to others, etc. As a general rule the chief and his

assistant should alternately direct the fire and the rescue companies, so that they will become equally proficient in the work of supervision.

The *ladder* and *hose men* should become proficient in the use of their apparatus—especially the latter should become accustomed to the " recoil " and " weight " of the hose. This is exceedingly important, especially where a high-pressure stream is used, as it is not only difficult to manage, but may cause fatal injuries to those whom it might strike.

Hose practice should include the connecting of hose to hydrants, leading it into buildings, and directing full stream upon roofs, etc. General drill for efficiency and speed in handling does not require water being turned on. Special care must be taken to prevent kinks and twists in hose;

these must be removed before water is turned on, otherwise hose may burst; bursting may also occur if hose is twisted or kinked after water is on. Hose containing short bends near nozzle is difficult to hold, and may recoil—only easy curves should be permitted.

Drill should be held at regular intervals, preferably once monthly, and without notice, with an occasional night drill. The hospital managers should personally review some or all of the drills. A record should be kept of the time required for drills, and special work done, as connecting of hose to hydrants, time for bringing apparatus, etc., and all concerned encouraged to maintain records, within such limitations as provide for their personal safety. The entire drill should be developed to a degree of military precision and discipline.

4. Inspection Service.—The work of inspection should be usually divided between the engineer and the night watchman, with a general inspection from time to time, especially during the *Winter*, by the superintendent and the managers. The *engineer's rules* should require that he make a daily inspection of the buildings, noting the condition of the valves, pipes, tanks, gauges, telltales, stand-pipes (obstructions, etc.), escapes, emergency pumps, water supplies, etc. In the instance of water-intakes located at lakes, ponds, brooks, or enclosed springs at some distance, the inspection, providing the service is usually satisfactory, need be made but once or twice monthly.

The *night-watchman's rules* should require that he note the condition and location of the fire appliances and safeguards, and daily report any defects, losses, or misplace-

ments, apparent violations of the fire rules, special hazards observed, or other observations he may make concerning fire matters. He should be provided with an approved *watchman's clock* (see U. Lab. list) and the stations so placed that his rounds will include the locations of fire appliances and of possible hazards (kitchens, engine, and dynamos, furnace rooms, etc.). He should have definite instructions as to his duties in any emergency.

5. Miscellaneous Considerations.— (*a*) *Hospital Fire Association.*—The plan of a private fire association as worked out by several corporations is worthy of adoption by the larger hospitals, as it has considerable merit. The scheme includes a regular organization of all who are concerned in the hospital fire department, having a constitution, by-laws, regular meetings, etc. Mem-

bership can be made a matter of merit, educational work can be done among the patients and employees, and the hospital morale improved to no small degree. Its work may be developed to include "Fire Day," with lectures, moving pictures, contests, etc.

(*b*) *Cooperation.*—*Neighbors* residing within hearing distance of the fire signal may be invited to respond to it. Such cooperation may be mutually valuable and advantageous.

Where arrangement has been made with a local *municipal fire department* to respond to calls, it should be given supreme charge immediately upon its arrival. However, no time should be lost awaiting such assistance, as even in cities the average time for a good fire department to arrive is several minutes, and minutes are hours for fire.

Furthermore, in rural buildings fires are seldom controlled after spreading beyond the incipient stage. (See also page 46.)

N.B.—In recent years, owing to the increased magnitude of the American Fire Problem, the study and practice of fire prevention and protection have become a distinct engineering specialty. Extensive literature has grown up about the subject, and treatises can be found on almost any of its phases. Those who wish to become better informed than is possible from this brief manual may find the following works useful:

"Field Practice," by N. F. P. A.

"Fire Prevention and Fire Protection," by J. K. Freitag (J. Wiley & Sons, New York City).

"A Cyclopedia of Fire Prevention and Insurance," which includes chapters by many fire specialists.

"The Prevention of Fire in Old Buildings Housing the Insane," by J. Allen Jackson, *N. Y. Medical Journal*, March 25, 1916.

Reports on tests of materials, building construction, etc., by the United States Geological Survey.

"Standard Rules and Requirements for Safeguarding Hazards," by N. F. P. A.

"State Laws and Municipal Ordinances for Regulating Fire Hazards," by N. F. P. A.

"Standard Rules and Requirements for Fire Protection," by N. F. P. A.

Educational pamphlets by N. F. P. A.